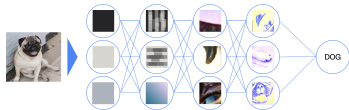


# Introduction to Machine Learning

## Neural Networks In a Nutshell

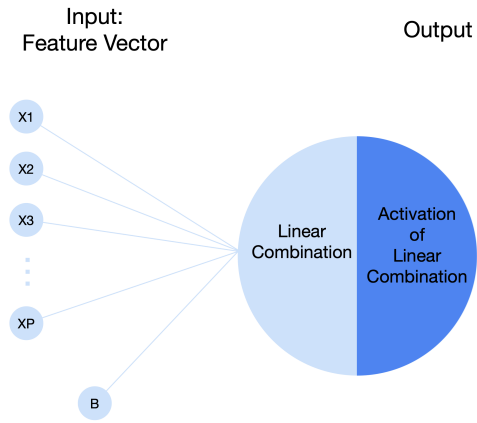


### Learning goals

- Know basic computational unit
- Know basic architecture
- Understand Learning in NNs

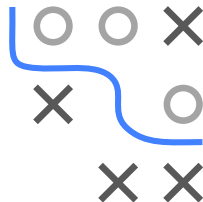


# BASIC COMPUTATIONAL UNIT: PERCEPTRON



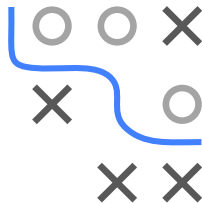
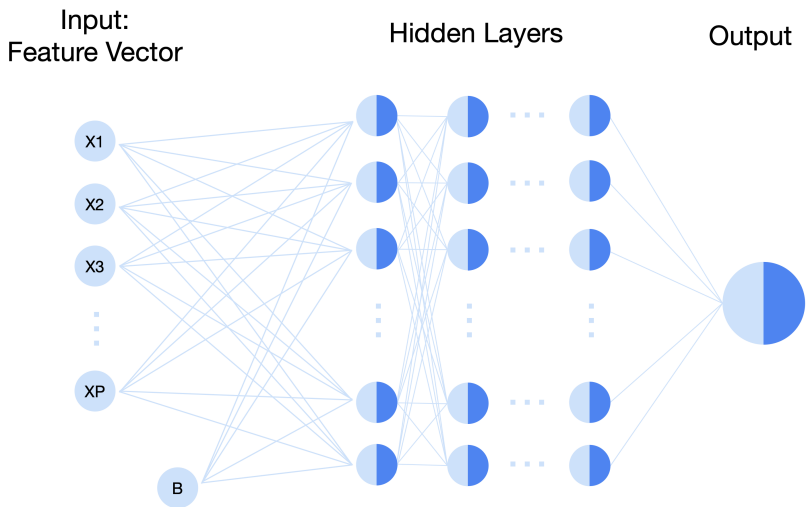
Output differs depending on activation function:

- **Identity function:**  
Perceptron represents linear regression
- **Logistic function:**  
Perceptron represents logistic regression
- Other activation functions possible



## BASIC ARCHITECTURE OF NN

A neural network is built by combination of multiple perceptrons:



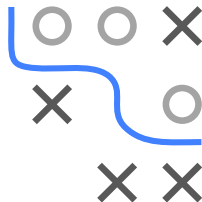
# BASIC ARCHITECTURE OF NN

## Hidden Layers:

- Output of hidden units serves as input for units in next layer
- Too many hidden layers or too many units per layer can lead to overfitting

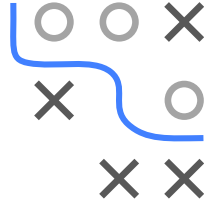
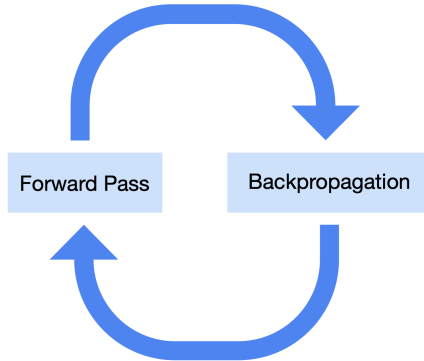
## Output Layer:

- Number of output units depend on task
- Different activation functions for output layer and hidden layers possible

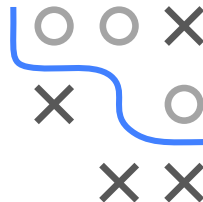
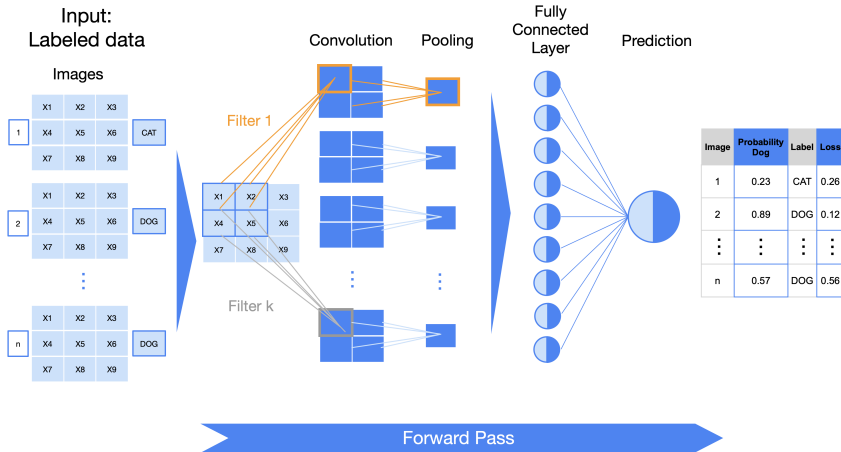


# LEARNING - IMAGE CLASSIFICATION TASK

For each Training Iteration:

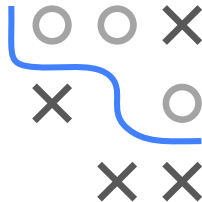
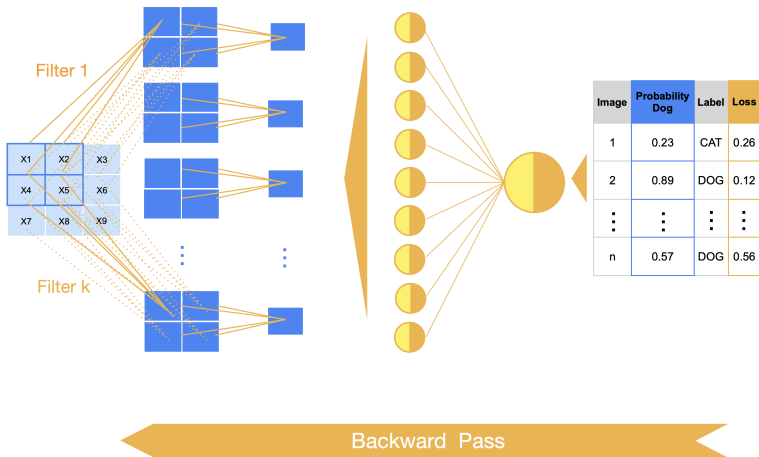


# LEARNING - IMAGE CLASSIFICATION TASK

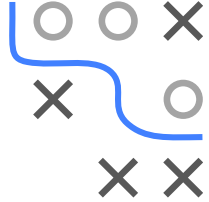
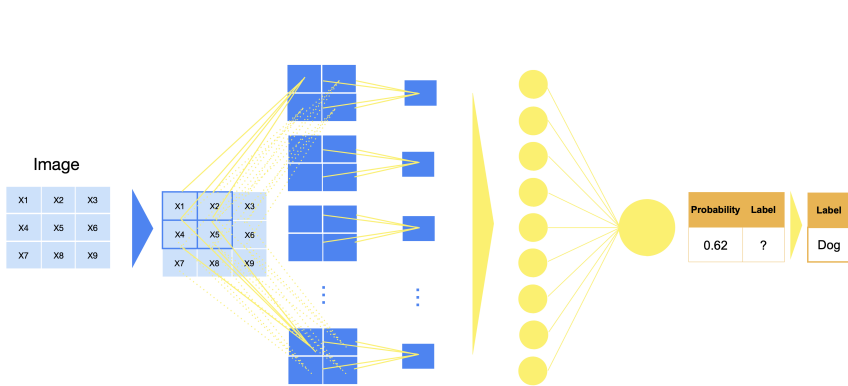


# LEARNING - IMAGE CLASSIFICATION TASK

Compute update of each weight by backpropagation



# PREDICTION - IMAGE CLASSIFICATION TASK





# EFFECT OF HIDDEN LAYERS

- Learn more and more abstract representations
- Each layer adds degree of non-linearity

